

# Is robotic better than laparoscopic approach for right colectomy?

## A cohort study from two Tuscany centers



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### Is robotic better than laparoscopic approach for right colectomy? A cohort study from two Tuscany centers

Robotic surgery is becoming more and more frequent. In colon surgery it can be used safely with similar results to laparoscopic surgery. The objective of our work is to retrospectively compare the short-term results (30 days) of robotic and laparoscopic right hemicolectomy. It will be helpful to understand if there are any advantages of robotic over laparoscopic surgery.

**METHODS:** Data of miniinvasive (laparoscopic and robotic) right colectomy procedures performed from January 1, 2013 to December 31, 2019 in two Tuscany hospitals were retrospectively collected and analyzed. The mean hospital stay, complication rate, flatus pass, operative time, conversion rate and the number of removed lymph nodes, between the two methods have been compared.

**RESULTS:** The total number of the patients that underwent right miniinvasive colectomy was 211. Sixteen patients were excluded from the study. Of the 195 included patients, 143 were operated with the robotic approach, and 52 with the laparoscopic one. There was no significant difference between the mean hospital stay (7 days in both), canalization to gas (4 days in both), anastomotic dehiscence (2 in robotic and 1 in laparoscopy), and Clavien Dindo 3 - 5 grade complications. The operation time (215 vs 175 min) and the number of retrieved lymph nodes (19 vs 15) were significantly greater in the robotic approach.

**CONCLUSION:** The robotic approach may be advantageous in terms of surgical radicality with the price of a greater operative time.

**KEY WORDS:** Laparoscopic, Right colectomy, Robotic

### Introduction

Miniinvasive surgery is replacing open surgery in almost all surgical disciplines, even if some perplexities still exist regarding the colon surgery. Some authors have questioned the oncological radicality of laparoscopy with respect to open surgery<sup>1,2</sup>.

Robotic approach is becoming more and more frequent. In colon surgery it can be used safely with similar results to laparoscopic surgery. It has the advantages of better visualization, better stability, wider range of motion of robotic wrist, tremor filtration and the disadvantages of greater operative time and cost<sup>3,4</sup>.

But does it have any advantage over laparoscopy in right hemicolectomy? Some studies have tried to answer to this question with disaccorded results<sup>3-7</sup>. Prospective studies are on the way to give more precise answers.

The CME technique for right colon cancer is becoming the gold standard<sup>8,9</sup>. It can be performed through the open surgery or with the mininvasive technique. The diffusion of CME technique for right hemicolectomy could benefit from the advantages of robotic platforms. Some studies have been realized to compare this, but the results of randomized studies are still lacking.

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The objective of our work is to retrospectively compare the short-term results (30 days) of standard robotic and laparoscopic right hemicolectomy. It will be helpful to understand if there are any advantages of robotic over laparoscopic surgery.

**Aim**

It has been shown that right hemicolectomy can be safely and with good oncological results executed in laparoscopy. In many centers, however, it is realized also with the robot use. The objective of this work is the analysis of the short term (30 days) results and surgical radicality comparison between laparoscopic and robotic right colectomy. As a secondary objective we have considered the post operative results between robotic right colectomy with intracorporeal and extracorporeal anastomosis.

**Methods**

This is a retrospective cohort study. The data of mini-invasive (laparoscopic and robotic) right colectomy operations executed from January 1, 2013 to December 31, 2019 in two Tuscany (Italy) centers have been collected and analyzed. The data have been collected by four general surgery residents.

The length of stay, complication rate, flatus pass, operation duration, conversion rate and the number of harvested lymph nodes have been compared between the two miniinvasive techniques.

The inclusion criteria were – miniinvasive operations for malign neoplasm, not performed in emergency setting. IBM SPSS statistics viewer program was used for the statistical analysis. Median and interquartile range (IQR) were used. For the dicotomic data comparison, Ki square test (or Fischer’s exact test when indicated) has been used. Manwhitney test was used for continuous data comparison.

Pathology	Robotic operations	Laparoscopic operations	Emergency operations (laparoscopic)
High grade displasia adenoma/not excisable polip	8 (1 death for anastomotic dehiscence)	2	
Adenocarcinoma complicated by perforation/abscess/occlusion			3 (1 death for postoperative perforation)
Complicated acute diverticulitis			1
Complicated acute appendicitis			2

**Results**

The total number of patients that underwent mininvasive right colectomy is 211. 195 patients were included and 16 excluded. The flowchart shows the patient selection.

The excluded cases present the following features:

Of the 195 included patients, 143 were operated with the robotic approach, and 52 with the laparoscopic one. There was no significant difference between the mean hospital stay (7 days in both), canalization to gas (4 days in both), anastomotic dehiscence (2 in robotic and 1 in laparoscopy), and Clavien Dindo 3 - 5 grade complications. The operation time (215 vs 175 min) and the number of retrieved lymph nodes (19 vs 15) were significantly greater in the robotic approach.

**Discussion**

No significant differences have been noted between the two groups (robotic and laparoscopic) regarding age and ASA score. The intracorporeal anastomosis is more frequently performed in the robotic approach than in the laparoscopic one. The number of harvested lymph nodes

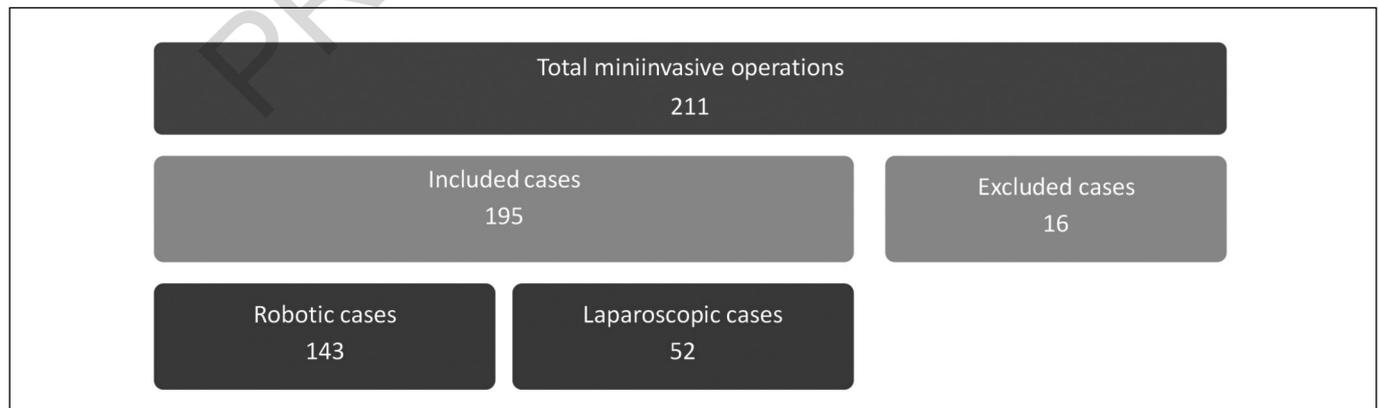


TABLE I - Features of patients and postoperative results

	Total operations	Robotic operations	Laparoscopic operations	P value (when indicated)
Number of operations	195	143	52	
Median age (IQR)	73	73 (66-79)	76 (67.25-80.75)	0.099
F/M ratio	94/101	69/74	25/27	0.73
Average ASA	2.36	2.29	2.46	0.19
Intracorporeal/total anastomosis ratio	85/195 (43.6%)	70/143 (48.9 %)	15/52 (28.8%)	0.000
Conversion ratio	20/195 (10.2%)	7/143 (4.9%)	13 (25%)	0.000
Operative median time in minutes (IQR)	210	215 (180-250)	175 (135-210)	0.000
Removed lymphnodes median (IQR)	18	19 (14-24)	15 (10.75-19.25)	0.001
Hospital length stay median (IQR)	7	7 (6-8)	7 (6-8)	0.831
Flatus pass median (IQR)	4	4 (3-5)	4 (3-5)	0.536
Anastomotic Dehiscence	3	2	1	0.79
Reoperation within 30 days from operation	5	4 (2 for anastomotic dehiscence, 2 for intestinal perforations)	1 (for anastomotic dehiscence)	
Complication rate	26.2%	24.5%	30.8%	0.262
Severe complication rate (Clavien Dindo 3-5)	3.2%	4.3%	0	0.164
Deaths	0	2	0	

TABLE II - Results comparison of robotic operations with intracorporeal and extracorporeal anastomosis.

	Robotic operations with extracorporeal operations (73 cases)	Robotic operations with intracorporeal anastomosis (70 cases)	P value (when indicated)
Operative time median (min)	220	215	
Length of stay median	7	7	
Flatus pass median	4	4	
Severe complication rate (Clavien Dindo 3-4)	4	2	0.11
Deaths	2	0	0.16

TABLE III - Tumor site

Cecum	68 (34.8%)
Ileo-cecal valve	6 (3.1%)
Ascending colon	78 (40%)
Hepatic flexure	31 (15.6%)
Trasvers colon	9 (4.6%)
Appendix	3 (1.5%)

TABLE IV - Disease stage

I	51
IIA	65
IIB	8
IIC	6
IIIA	5
IIIB	35
IIIC	13
Iva	5

is greater with robotic hemicolectomy than the laparoscopic colectomy, and so is the operation duration.

The conversion rate was higher in the conventional laparoscopy. While there was no difference between the 30 days complication rate, the length of stay, flatus pass between the laparoscopic and robotic technique and between robotic intracorporeal and extracorporeal anastomosis technique.

The age difference, although not statistically significant, may be a confounding factor, considering that the life expectancy of older population is lower, and the surgical operation may have been less radical.

Some limitations of this paper are: a. the operations have been executed by different surgeons, five in total (one has performed only robotic operations, two only laparoscopic and the other surgeons robotic and laparoscopic operations); b. the age difference between the two groups, which although not statistically significant can be a confounding factor, considering that the life

expectancy of the older group is lower and therefore the operation may have been less radical.

Right laparoscopic colectomy is a safe procedure for the surgical treatment of right colon tumor. Many works have shown the advantages of laparoscopy (less pain, wound infections, length of stay and complications, and life quality) towards the open procedure and its oncological non inferiority<sup>10-13</sup>

ESMO guidelines consider the laparoscopic right colectomy a safe procedure when it's performed by experienced surgeons<sup>(14)</sup>. However, in a recent work, Jurovich et al.<sup>(1)</sup> analyzed the data on robotic and laparoscopic right colectomy of the German national registry of colon cancer (StuDoq). They took in consideration the short-term surgical results and the number of harvested lymph nodes (as an indicator of surgical radicality) and noted that the number of harvested lymph nodes during the laparoscopic procedure was lower than the number in open procedure, suggesting that this could compromise the oncological results. They advise, therefore, a critical consideration when choosing the laparoscopic procedure for the treatment of right colon cancer. Yana et al.<sup>2</sup> have analyzed the data of American register NSQIP and discovered that there is a greater possibility that the laparoscopic procedure for right colon cancer obtain less than 12 lymph nodes with respect to the open procedure. While previously, (2008) "The Colon Cancer Laparoscopic or Open Resection Study Group"<sup>15</sup>, analyzing the data from 29 European hospitals, was not able to show the oncological non inferiority of the laparoscopic procedure for the right colon cancer. Nevertheless, they advised the laparoscopic surgery considering the small difference of survival and the short-term advantages. The CME technique proposed by Hohenberger<sup>8</sup>, significantly increases the survival. In it the number of obtained nodes is higher than in the standard technique. The higher nodes number assures a better staging and surgical radicality. The German Guidelines Program in Oncology (CGPO) guidelines for rectum and colon cancer have introduced CME as the standard technique for the surgical treatment of right colon. Many centers have started to implement the procedure laparoscopically. Its execution could increase the operator risk for the patient<sup>16,17</sup>, although some authors have not noted differences between the two techniques<sup>18</sup>. There is a higher risk to damage the venous vascular structures such as superior mesenteric vein and the trunk of Henle. CME standardization can lead to a risk reduction.

Currently, robotic right colectomy is being executed more frequently. It is considered a safe procedure with oncological results comparable to laparoscopic procedure, but with higher costs<sup>3,5</sup>. It has been shown that the operator time increases significantly during robotic surgery with respect to laparoscopic of open procedure<sup>4-6</sup>. We had the same result in this work. This can expose patients to anesthesiology related risks (metabolic acidosis, body temperature lowering, etc) and increase the

costs. Some studies (including the current one) have shown that the number of harvested lymph nodes is higher if the procedure is performed robotically<sup>3,5-6</sup>. While other authors have had similar numbers - A. As previously mentioned, the harvested lymph node number represents a surgical radicality indicator. The advantages offered by the robot could permit an easier anastomosis execution that can derive from the three-dimensional vision, minor tremor, better ergonomics for the surgeon and from the greater mobility of robotic pulse. Some authors have shown a lower length of stay, a quicker postoperative gas canalization and reduced complications for the robotic operation<sup>6,19</sup>, although these papers have had as a bias the more frequent execution of intracorporeal anastomosis of the robotic operation. Solaini et al.<sup>5</sup> instead, have shown similar complications, even if the anastomosis is made intracorporeally.

In our work the overall complication rate is lower in the robotic group, while it is higher for severe complications (Clavien 3-5). When considering the robotic operations with intracorporeal and extracorporeal anastomosis of this work, there have been 2 major complications and no death in the laparoscopic group and 4 major complications and 2 deaths in the robotic group. However, the complication difference between the two groups does not reach a statistical significance. There have been no differences regarding the mean length of stay and first flatus pass. This is, to our best knowledge, the only study that compares the robotic right hemicolectomy with intracorporeal and extracorporeal anastomosis.

We found a higher conversion rate in the laparoscopic approach. A 2018 metanalysis (20) had the same result. Most of the papers that compare the two approaches are retrospective. Prospective studies and long-term results are necessary. Studies that compare laparoscopic CME and standard approaches are also necessary.

## Conclusions

The robotic right colectomy may offer advantages in terms of oncological radicality with the cost of a greater operative time.

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## Riassunto

La chirurgia miniinvasiva sta sostituendo la chirurgia a cielo aperto in quasi tutte le discipline chirurgiche. L'uso

del robot nella chirurgia laparoscopica invece sta diventando sempre più frequente. Ad esso vengono riconosciuti dei vantaggi come la migliore visualizzazione, maggiore stabilità, più grande amplitudine di movimento del polso robotico, la filtrazione del tremore e degli svantaggi come il più lungo tempo operatorio e il costo più alto. Alcuni studi hanno cercato di confrontare la chirurgia robotica e laparoscopica con risultati discordanti. La diffusione della tecnica CME per l'emicolectomia destra potrebbe beneficiare dalla piattaforma robotica.

Lo scopo del nostro studio è stato il confronto ai risultati a breve termine dell'emicolectomia destra robotica e laparoscopica. I dati delle procedure di emicolectomia destra robotica e laparoscopica eseguite dal 1 gennaio 2013 al 31 dicembre 31 2019 in due ospedali toscani sono stati raccolti e analizzati retrospettivamente. Sono stati confrontati la degenza media, le complicanze, la canalizzazione ai gas, il tempo operatorio, la percentuale di conversione e il numero dei linfonodi asportati fra le due tecniche robotiche.

Il numero totale dei pazienti sottoposti a emicolectomia destra robotica e laparoscopica è stato 211. Sedici pazienti sono stati esclusi dallo studio. Dei 195 pazienti inclusi, 143 sono stati operati con la tecnica robotica e 52 con la tecnica laparoscopica. Non ci sono state differenze riguardo la degenza media (7 giorni per entrambi), canalizzazione ai gas (4 giorni per entrambe le procedure), la deiscenza anastomotica (2 con la tecnica robotica e 2 in laparoscopia), e le complicanze Clavien-Dindo 3-5. Il tempo operatorio (215 vs 175 minuti) e il numero dei linfonodi asportati (19 vs 15) è stato significativamente più grande nell'approccio robotico.

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